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Dogwood Anthracnose and its Spread in the South

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Dogwood Anthracnose and Its Spread in the South

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Abstract

In the 15 years since it was first reported in the United States, dogwood anthracnose (caused by *Discula destructiva* sp. nov.) has spread rapidly and caused serious losses among flowering dogwoods (*Cornus florida* L.), particularly in the South. Infection begins in leaves and spreads to twigs and branches, which dieback. Main-stem infections cause cankers, which kill the trees. In the South, infection is most likely at higher elevations and on moist to wet sites. Shade increases risk of infection and mortality. High-value trees can be protected by mulching, pruning, and watering during droughts, and applying a fungicide.

Introduction

Dogwood anthracnose was first reported as a disease of flowering dogwood in the United States in 1978. In 15 years, it has caused serious losses to flowering dogwood found in the forest and in ornamental plantings over large portions of the Eastern and Southern United States. The fungus that causes the disease was fully described and identified as *Discula destructiva* sp. nov. in 1991 (Redlin 1991). This article summarizes the spread, impact, and control efforts under forest as well as ornamental conditions for flowering dogwoods since the disease was discovered in the South in 1987.

It is too soon for reliable projections about the future of flowering dogwood in the many forest types in which it grows. This species is an important understory and midstory component of many ecosystems in the South. Its loss from any of these systems would have significant ecological consequences, and people would sorely miss its spring and fall displays. In addition wildlife species depend on dogwood for food and cover. The extent of mortality has been alarming in some places and moderate in others. Reliable treatments have been devised for protecting high value trees, but no practical treatment is available under a general forest situation.

Symptoms

Initial symptoms of dogwood anthracnose are small tan leaf spots (figure 1) that develop into large tan blotches.

Figure 1—Small leaf spots caused by Discula destructiva.

Often a purple border occurs between dead and healthy tissues and occasionally the entire leaf is killed (figure 2).

Figure 2—Large leaf spots and leaf mortality.

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EXPERIMENT STATION

In many cases, infected mature leaves are aborted prematurely; in other cases, infected leaves cling to the stems after normal leaf fall (figure 3).

Figure 3—Leaves clinging to stem in winter.

Infections expand from leaves into small twigs (figure 4).

Figure 4—Infected shoot showing fruiting bodies of the fungus on the dead area of the shoot.

Symptoms typically start in the lower crown and progress up the tree (figure 5).

Figure 5—Tree showing lower branch mortality symptom.

The dieback of twigs and branches in the lower crown led to the original name of "lower-branch dieback" (Pirone 1980). Further knowledge of the pathogen allowed the disease to be renamed "dogwood anthracnose." Numerous epicormic shoots often form along the entire length of the main stem and on major branches of infected plants. These shoots frequently become infected and die (figure 6), and the infections proceed from the shoots into the main stem.

Figure 6—Dogwood stem with symptomatic epicormic shoots.

The fungus causes cankers (figure 7) that can kill the tree. Cankers may not be present on all the dead trees. Larger trees often die 2 to 3 years after the first symptoms are found in the leaves.

The disease kills dogwoods of all sizes, but it is most severe on young seedlings and in understory forest dogwoods. Infection of dogwoods is most likely to occur during cool, wet weather in spring and fall, but can occur at any time during the growing season. Ornamentals are often disfigured without being killed, particularly if they are growing in open, sunny sites. Overall, vigorous trees tend to be less damaged than weak trees. The disease is often more severe on trees growing in full shade, and it is reported to be greatest on northeast-facing slopes and in areas where dogwood are abundant (Chellemi et. al. 1992). Drought

and winter injury appear to increase susceptibility. Consecutive years of infection have killed high proportions of woodland and ornamental dogwood populations (Daughtrey and Hibben 1983).

Figure 7—Canker of dogwood with bark removal.

In the early stages of the disease, the symptoms are often similar to those of other, less serious conditions. For example:

(1) Spot anthracnose, caused by *Elsinoe corni* Jenk & Bot., infects leaves in the spring, causing numerous small spots that can coalesce into large spots (figure 8).

Figure 8—Leaves with many leaf spots caused by Elsinoe corni. In some cases, they merge to cause large dead areas on the leaves.

(2) Leaf spots, caused by *Septoria cornicola* Desm., often appear in late summer or fall. The spots are about 1/4 inch in diameter with square shaped margins. The spots may merge to form large blotches. *Septoria* spots can have purple margins like those of dogwood anthracnose (figure 9).

Figure 9—Leaf spots caused by Septoria cornicola.

(3) The dogwood twig borer (*Oberea tripunctata* Swederus) kills shoots, causing the leaves to hang on the tree as they may in dogwood anthracnose. The main difference is that foliage affected by twig borer damage is clumped rather than scattered throughout the affected portion of the tree crown. The emerging borer causes a hole in the affected shoot.

(4) Mechanical injuries and drought can also cause symptoms in foliage and branches that mimic dogwood anthracnose.

To confirm the presence of *Discula destructiva*, tissue must be examined in a laboratory.

Disease History

In 1978, Pirone noticed a widespread and rapid deterioration of flowering dogwoods in New York and Connecticut (Pirone 1980). In 1983, Daughtrey and Hibben reported a lower-branch dieback disease of flowering dogwoods in New York, Connecticut, New Jersey, and Pennsylvania. Studies of trees at the Planting Fields Arboretum in Oyster Bay, Long Island, and on a woodland site at the Brooklyn Botanic Garden Research Center in Ossining, NY, determined that that the disease was caused by a species of *Discula*.

The origin of the disease is not known, but its sudden onset and rapid spread have led many to conclude that it was introduced. Daughtrey and Hibben (1983) considered that the disease was possibly exotic and also speculated that climatic changes could have influenced coincidental outbreaks in the Northeast and the Pacific Northwest. Hudler (1985) proposed that droughts or sudden climatic changes may have predisposed trees to infection.

In 1984, a survey of Catoctin Mountain National Park in Maryland revealed that only 3% of the dogwoods were free of dogwood anthracnose and that 33% were dead (Mielke and Langdon 1986). A follow-up survey in 1988 revealed 89% of dogwoods dead, almost no flowering dogwood regeneration, and all live trees infected with dogwood anthracnose (Schneeberger and Jackson 1989). By 1987, dogwood anthracnose had been reported in over 60 counties in 8 Northeastern States—Connecticut, Maryland, Massachusetts, New Jersey, New York, Pennsylvania, Virginia, and West Virginia.

A similar disease was found on western flowering dogwoods, (*Cornus nuttallii* Audubon) in western Washington in 1979 and named "dogwood anthracnose" (Byther and Davidson 1979). By 1983, the disease had also been found in Oregon, Idaho, and British Columbia, and the causal fungus was determined to be in the genus *Discula* (Salogga and Ammirati 1983). Daughtrey and Hibben (1983) compared the symptoms, and signs on eastern and western flowering dogwoods and concluded that the same disease was occurring in the East and the West.

Spread in the South

In the late 1970s, there was considerable speculation about whether dogwood anthracnose would spread into the South. It has. Its presence was confirmed in northern Georgia in 1987 and in western North Carolina in 1988 (Anderson et. al. 1990; USDA 1988). A dogwood anthracnose working group composed of representatives from State and Federal agencies was formed in 1988. This group meets annually to exchange information on the progress of the disease and to discuss the research that is underway.

Since it was discovered in the South, dogwood anthracnose has spread through the entire Southern Appalachian Mountains (figure 10) and its

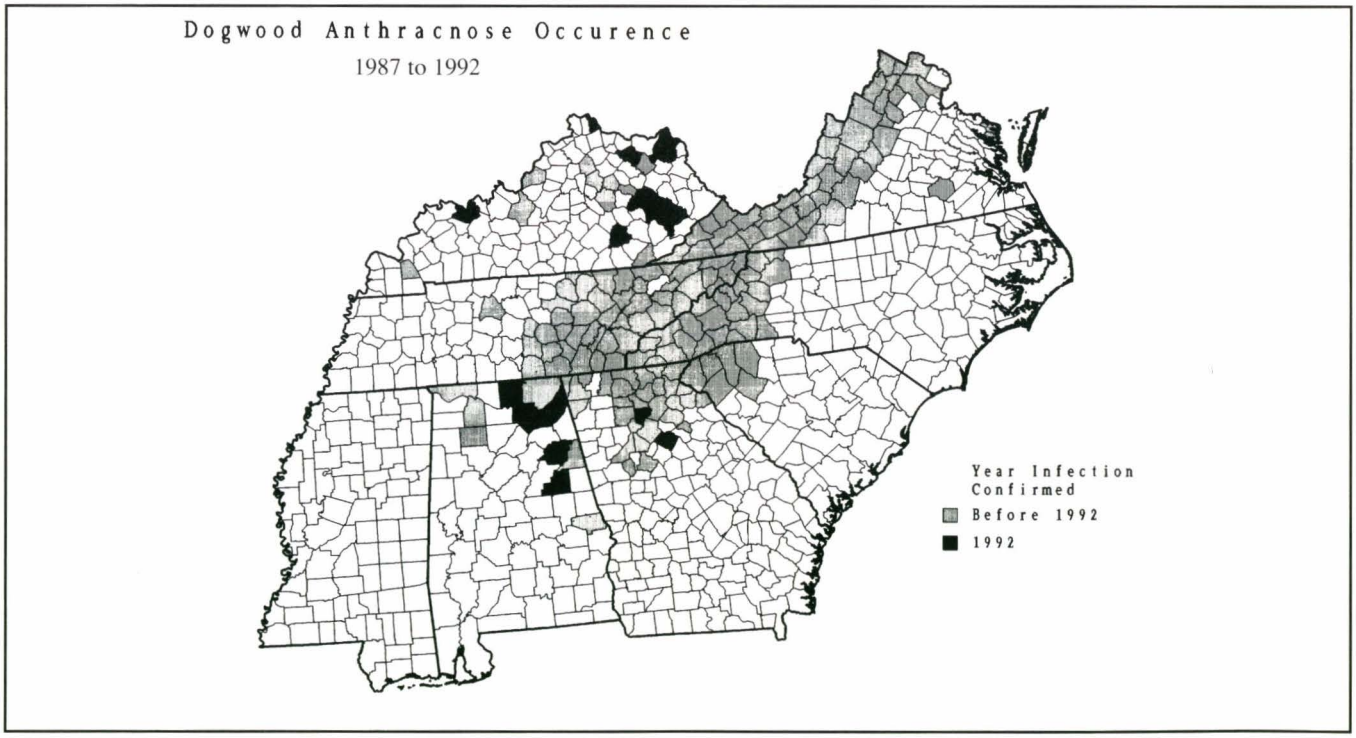


Figure 10—Dogwood anthracnose occurrence in the South (Data are from State and Federal personnel.)

presence has been confirmed in several counties outside the Appalachians. For a county to be included on the map, *Discula destructiva* must have been positively identified in diseased dogwood and one must still be able to find the disease in the county. Data has been provided by State, Federal, and private individuals. The actual distribution in the South may be wider than that shown in figure 10. Since we began tracking disease in the South, the number of counties with infected trees has increased from 3 in 1987 to 182 in 1992. Although it is unlikely that the disease spread that rapidly in just 5 years, it is our impression that its spread was indeed rapid (Knighten and Anderson 1993a) (Knighten and Anderson 1992).

Disease severity in the South seems to be more intense at higher elevations. In general, damage is most severe at elevations above 3,000 feet (where most of the forest and ornamental dogwoods are dying), less severe at 2,000 to 3,000 feet (where forest dogwood and ornamental trees in the shade are dying), and even less severe below 2,000 feet (where trees in cool, wet areas are dying). The reason for this elevation gradient is not clear, but it may be that the cool, wet environment of the mountains and foothills is most conducive to disease development (Windham 1990).

Beginning in 1990 and ending in 1993, 210 plots were established to monitor disease severity under forest conditions at 15-minute intervals of latitude and longitude in a grid pattern. The plots were established on State and private lands by each state Forestry personnel in respective states, and the USDA Forest Service personnel on Federal lands. The nearest 10 dogwoods to plot center were given a disease rating based on the following scheme:

- 0 (dead),
- 1 (>75 percent of foliage symptomatic),
- 2 (51- 75 percent of foliage symptomatic),
- 3 (26-50 percent of foliage symptomatic),
- 4 (1-25 percent of foliage symptomatic), or
- 5 (foliage healthy).

Thirty of the 210 plots were established in 1988 and data have been collected annually. In 1988, none of the trees on these plots were dead and only 4 percent were severely affected. By 1992, 17 percent were dead and 19 percent had severe symptoms (Knighten and Anderson 1993) (table 1). The forest environment has been the focus on the survey and impact assessment.

Table 1—Changes in dogwood tree damage class ratings from 1988 to 1992 (Based on 30 permanent plots established in 1988).

Damage class[1]	Percentage of dogwood trees in each class				
	1988	1989	1990	1991	1992
5	38	8	24	24	15
4	51	66	48	38	36
3	7	17	14	15	13
2	3	4	7	7	7
1	1	4	4	7	12
0	0	1	3	8	17

[1] 5 = Healthy
4 = 1-25% of foliage affected
3 = 26-50% of foliage affected
2 = 51-75% of foliage affected
1 = >75% of foliage affected
0 = Dead

Control Procedures

Control procedures are not available at this time for dogwoods grown in the forest environment. However, a number of techniques are available to deal with the disease in generally high-value settings, such as recreation sites or urban settings (figure 11).

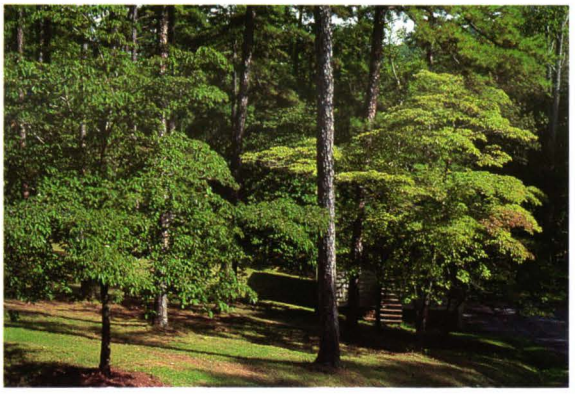


Figure 11—Dogwoods in high value setting.

High-Value Trees

Managers and homeowners can consider planting new flowering dogwoods if they are willing to follow the Decision Key and the Ten Essential Steps outlined below:

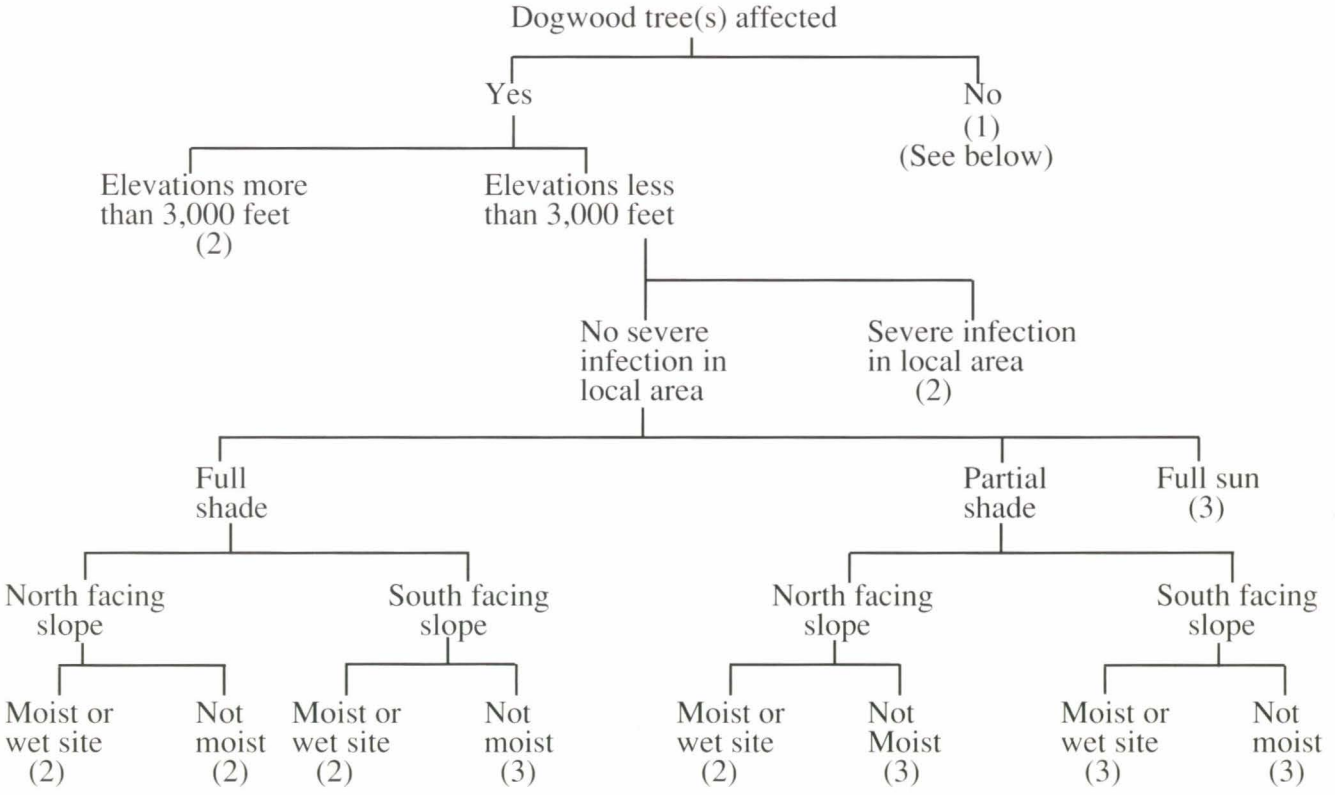
Ten Essential Steps to Prevent/Control Dogwood Anthracnose

1. Know the symptoms of dogwood anthracnose and other problems that commonly affect dogwoods. Inspect trees frequently to detect the presence of the disease in its early stages.

2. Select healthy planting stock. Never plant diseased stock. Purchase trees from a reputable nursery. If symptoms are seen on the planting stock, dispose of the infected trees. Avoid transplanting trees from the forest, especially from mountainous areas.

Dogwood Anthracnose Decision Key

(For use primarily in urban or high-value areas)



(1) Apply 10 essential steps; omit fungicide.
(2) Use 10 essential steps or use other tree species.
(3) Apply 10 essential steps, omit fungicide, and monitor.

3. Select reasonably well-drained planting sites with fertile soils. Avoid sites along streams, lakes, or ponds where moisture will remain on the foliage for many hours after sunrise. In high-hazard areas, plant flowering dogwoods only in full sun.

4. Planting holes should extend well beyond the root system of your planting stock, and should be filled with a rich mixture of soil and humus. Be sure the root collar is placed at ground level.

5. Mulch around newly planted and existing trees to a depth of 2-4 inches. Be sure the mulch does not touch the stem, and avoid using dogwood leaves or chips.

6. Prune and completely remove or destroy dead wood in the tree and leaves on the ground yearly. Avoid flush cuts, being sure to leave the branch collar. Prune all epicormic branches in late summer.

7. Water weekly during droughts. Water in the morning and avoid wetting the foliage.

8. Fertilize to provide nutrient-rich soil. Have soil tested to be certain what quantities of nutrients are needed.

9. Avoid mechanical and chemical injuries to the trees. Lawnmower and string-trimmer wounds are particularly troublesome.

10. Apply fungicides registered for prevention or control of dogwood anthracnose when it is necessary to do so. Fungicides (Banner and Daconil 2787 are registered for control) should be applied as buds are breaking in the spring and at least twice thereafter as the leaves are expanding. Check with your local Extension Service about registration and use before applying any fungicide.

Additional information on protection of ornamentals is available in two Forest Service publications. Mielke and Daughtrey (1989) provide recommendations for the Northeast. Bailey and Brown (1989) key their recommendations to conditions in the Southeastern United States.

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PESTICIDE PRECAUTIONARY STATEMENT

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried in a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure intended use is still registered.

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